CHAPTER 12

12-1. Suppose there are 100 workers in an economy with two firms. All workers are worth $35 per hour to firm A but differ in their productivity at firm B. Worker 1 has a value of marginal product of $1 per hour at firm B; worker 2 has a value of marginal product of $2 per hour at firm B, and so on. Firm A pays its workers a time-rate of $35 per hour, while firm B pays its workers a piece rate. How will the workers sort themselves across firms? Suppose a decrease in demand for both firms' output reduces the value of every worker to either firm by half. How will workers now sort themselves across firms?

Workers 1 to 34 work for firm A as a time rate of $35 is more than their value to firm B, while workers 36 to 100 work for firm B. Worker 35 is indifferent. More productive workers, therefore, flock to the piece rate firm. After the price of output falls, firm A values all workers at $17.50 per hour, while worker 1's value at firm B falls to 50 cents, worker 2's value falls to $1 at firm B, etc. The key question is what happens to the wage in the time-rate firm. Presumably this wage will also fall by half to $17.50 per hour. If it falls by half, then the sorting of workers to the two firms remains unchanged.

12-2. Taxicab companies in the United States typically own a large number of cabs and licenses; taxicab drivers then pay a daily fee to the owner to lease a cab for the day. In return, the drivers keep their fares (so that, in essence, they receive a 100 percent commission on their sales). Why did this type of compensation system develop in the taxicab industry?

Imagine what would happen if the cab company paid a 50 percent commission on fares. The cab drivers would have an incentive to misinform the company about the amount of fares they generated in order to pocket most of the receipts. Because cab companies find it almost impossible to monitor their workers, they have developed a compensation scheme that leaves the monitoring to the drivers. By charging drivers a rental fee and letting the drivers keep all the fares, each driver has an incentive to not shirk on the job.

12-3. A firm hires two workers to assemble bicycles. The firm values each assembly at $12. Charlie's marginal cost of allocating effort to the production process is $MC = 4N$, where N is the number of bicycles assembled per hour. Donna's marginal cost is $MC = 6N$.

(a) If the firm pays piece rates, what will be each worker's hourly wage?

As the firm values each assembly at $12, it will pay $12 for 1 assembly, $24 for 2 assembly's, etc. when offering piece rates. As Charlie's marginal cost of the first assembly is $4, the second is $8, the third is $12, and the fourth is $16; Charlie assembles 3 bicycles each hour and is paid an hourly wage of $36. Likewise, as Donna's marginal cost of the first assembly is $6, the second is $12, and the third is $18; Donna assembles 2 bicycles each hour and is paid an hourly wage of $24.

(b) Suppose the firm pays a time rate of $15 per hour and fires any worker who does not assemble at least 1.5 bicycles per hour. How many bicycles will each worker assemble in an 8 hour day?

As working is painful to workers, each will work as hard as necessary to prevent being fired, but that is all. Thus, each worker assembles 1.5 bicycles each hour, for a total of 12 bicycles in an eight hour day.

12-4. All workers start working for a particular firm when they are 20 years old. The value of each worker's marginal product is $18 per hour. In order to prevent shirking on the job, a delayed-compensation scheme is imposed. In particular, the wage level at every level of seniority is determined by:

$$\textbf{Wage} = \$10 + (.4 \times \textbf{Years in the firm}).$$

Suppose also that the discount rate is zero for all workers. What will be the mandatory retirement age under the compensation scheme? (Hint: Use a spreadsheet.)

To simplify the problem, suppose the workers works 1 hour per year. (The answer would be the same regardless of how many hours are worked, as long as the number of hours worked does not change over time). Some of the relevant quantities required to determine the optimal length of the contract are:

Age	Years on the Job	VMP	Accumulated VMP	Contract Wage	Accumulated Contract Wage
21	1	$18	$18	$10.00	$10.00
22	2	$18	$36	$10.40	$20.40
23	3	$18	$54	$10.80	$31.20
24	4	$18	$72	$11.20	$42.40
40	20	$18	$360	$17.60	$276.00
41	21	$18	$378	$18.00	$294.00
42	22	$18	$396	$18.40	$312.40
43	23	$18	$414	$18.80	$331.20
60	40	$18	$720	$25.60	$712.00
61	41	$18	$738	$26.00	$738.00
62	42	$18	$756	$26.40	$764.40

The VMP is constant at $18 per year. The accumulated VMP gives the total product the worker has contributed to the firm up to that point in the contract. The wage in the contract follows from the equation, and the accumulated wage is the total wage payments received by the worker up to that point. Until the 20th year in the firm, the worker receives a wage lower than her VMP; after the 21st year the worker's wage exceeds the VMP. The contract will be terminated when the total accumulated VMP equals the total accumulated wage under the delayed compensation contract, which occurs on the worker's 41st year on the job. So the optimal retirement age is age 61.

12-5. Suppose a firm's technology requires it to hire 100 workers regardless of the wage level. The firm, however, has found that worker productivity is greatly affected by its wage. The historical relationship between the wage level and the firm's output is given by:

Wage Rate	Units of Output
$8.00	65
$10.00	80
$11.25	90
$12.00	97
$12.50	102

What wage level should a profit-maximizing firm choose? What happens to the efficiency wage if there is an increase in the demand for the firm's output?

The data in the problem can be used to calculate the elasticity of the change in output with respect to the change in the wage. The efficiency wage is determined by the condition that this elasticity must equal 1. This elasticity is 1 when the firm raises the wage from $10 to $11.25 an hour: (90-80)/80 ÷ (11.25-10)/10 = 1. The efficiency wage, therefore, is $11.25. Note that this efficiency wage is independent of any labor market conditions, and particularly does not depend on the demand for the firm's output.

12-6. Consider three firms identical in all aspects except their monitoring efficiency, which cannot be changed. Even though the cost of monitoring is the same across the three firms, shirkers at Firm A are identified almost for certain; shirkers at Firm B have a slightly greater chance of not being found out; and shirkers at Firm C have the greatest chance of not being identified as a shirker. If all three firms pay efficiency wages to keep their workers from shirking, which firm will pay the greatest efficiency wage? Which firm will pay the smallest efficiency wage?

In this example, there is no connection between the cost of monitoring and the efficiency of monitoring. Moreover, the value of unemployment is the same for workers regardless of their employer. Focusing just on the probability of being caught shirking, therefore, workers in Firm A have the least incentive to shirk (as they are most likely to get caught) while workers in Firm C have the greatest incentive to shirk (as they are least likely to get caught). The idea of efficiency wages is to use wages to buy-off the incentive to shirk. Therefore, Firm A will pay the lowest efficiency wage, while Firm C will pay the greatest efficiency wage.

12-7. Consider three firms identical in all aspects (including the probability with which they discover a shirker), except that monitoring costs vary across the firms. Monitoring workers is very expensive at Firm A, less expensive at Firm B, and cheapest at Firm C. If all three firms pay efficiency wages to keep their workers from shirking, which firm will pay the greatest efficiency wage? Which firm will pay the smallest efficiency wage?

In this example, there is no connection between the cost of monitoring and the efficiency of monitoring. The efficiency wage, therefore, is determined by the incentives of the workers, not the costs of the firms. (The decision of whether to monitor workers, of course, will depend on the cost of monitoring.) Thus, all three firms will offer the same efficiency wage.

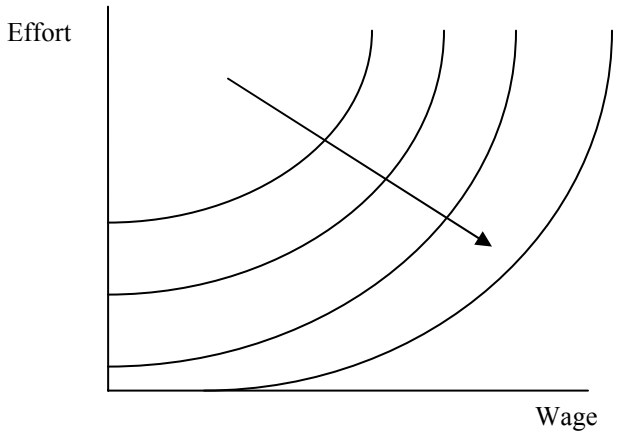
12-8. Why will a firm be more likely to pay its factory workers according to a time rate, but be more likely to pay its sales people a piece rate?

Each factory worker has a place on an assembly line and must do a certain task for each unit of the product made. Thus, the production process requires very little monitoring of workers, as they are more or less forced to do their job or else the assembly line will breakdown, with the factory manager knowing who is at fault. This is the ideal situation in which to pay a time rate.

In comparison, sales persons are likely paid a piece rate, because monitoring their efforts is much more difficult. By paying a piece rate, the sales people have an incentive to work hard to make as many sales as possible.

12-9. Suppose a worker only cares about her wage (a "good") and how much effort she exerts on the job (a "bad"). Graph some indifference curves over these two goods for the worker.

Indifference Curves: Wages and Effort



With the wage on the horizontal axis, any shaped indifference curves as long as they are upward sloping and increasing in the direction of higher wages and less effort fulfill the requirements that wages are a good thing and effort is a bad thing.

12-10. Why would a firm ever choose to offer profit-sharing to its employees in place of paying piece rates?

Piece rates can be very difficult to pay in some situations. For example, in a situation in which a group of workers is responsible for producing the good, determining who made what may be impossible. Consider Southwest Airlines, which is known to have a wonderful profit sharing program. To pay a flight attendant a piece rate, the airline would have to survey passengers as they depart the plane, and then, from the passengers' opinions, pay the appropriate piece rates. Clearly this is unreasonable. Profit sharing, on the other hand, is a convenient way to approximate the piece rate system. Since all workers are covered by profit sharing at Southwest Airlines, all workers have a continuous incentive to do their job very well.

12-11. Describe the free riding problem in a profit-sharing compensation scheme. How might the workers of a firm "solve" the free riding problem?

When all workers are covered by a profit sharing plan, an individual worker has the incentive to shirk his responsibilities as his direct effect on profits is tiny. If all workers do this, however, the total profit created by the firm will be much smaller than it would be if workers were paid a piece rate.

One way to "solve" the free rider problem is with social pressure. If the atmosphere of the workers is that everyone works and shirkers will be punished somehow – socially, annual reviews, being fired, etc. – then the incentive to shirk is diminished.